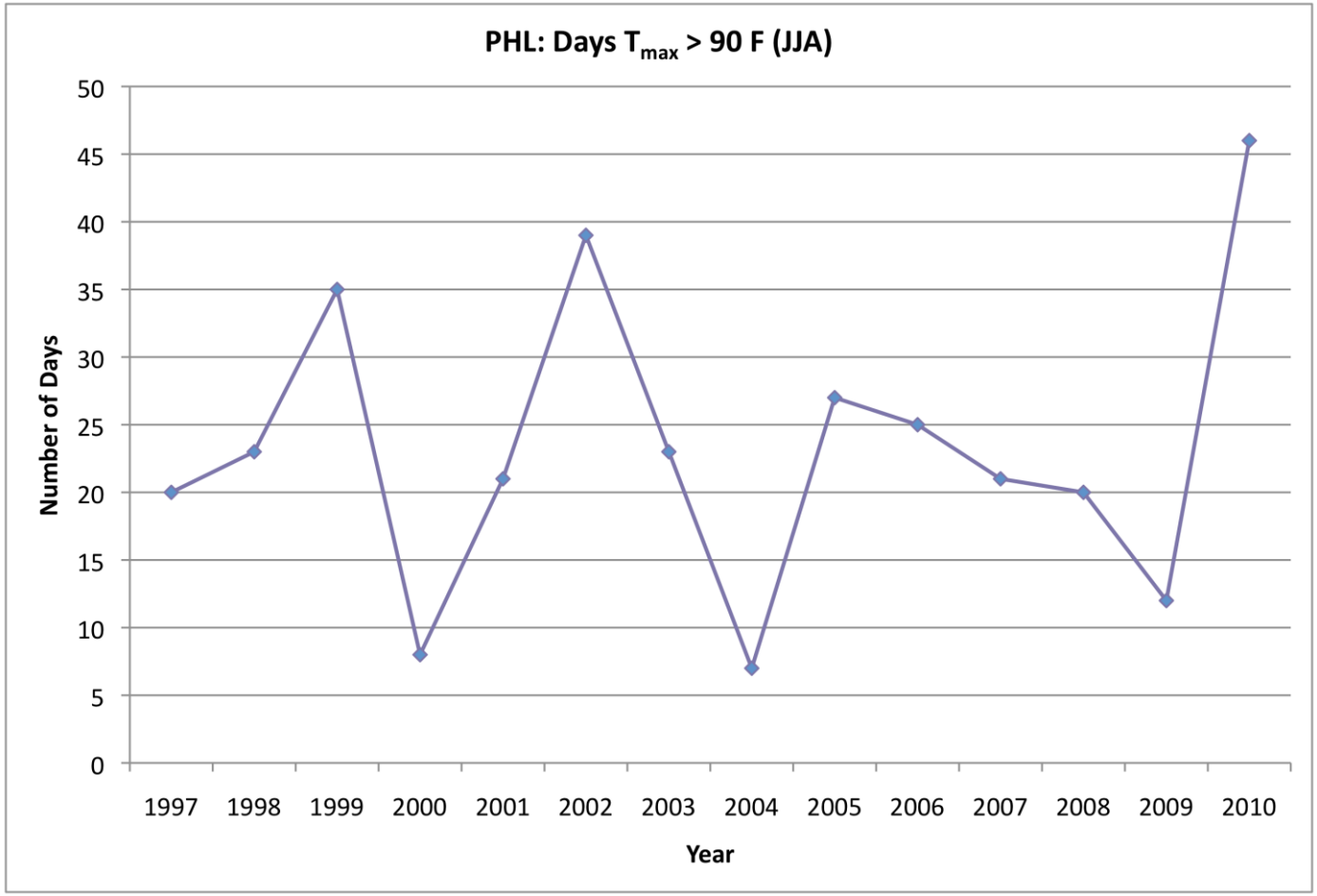
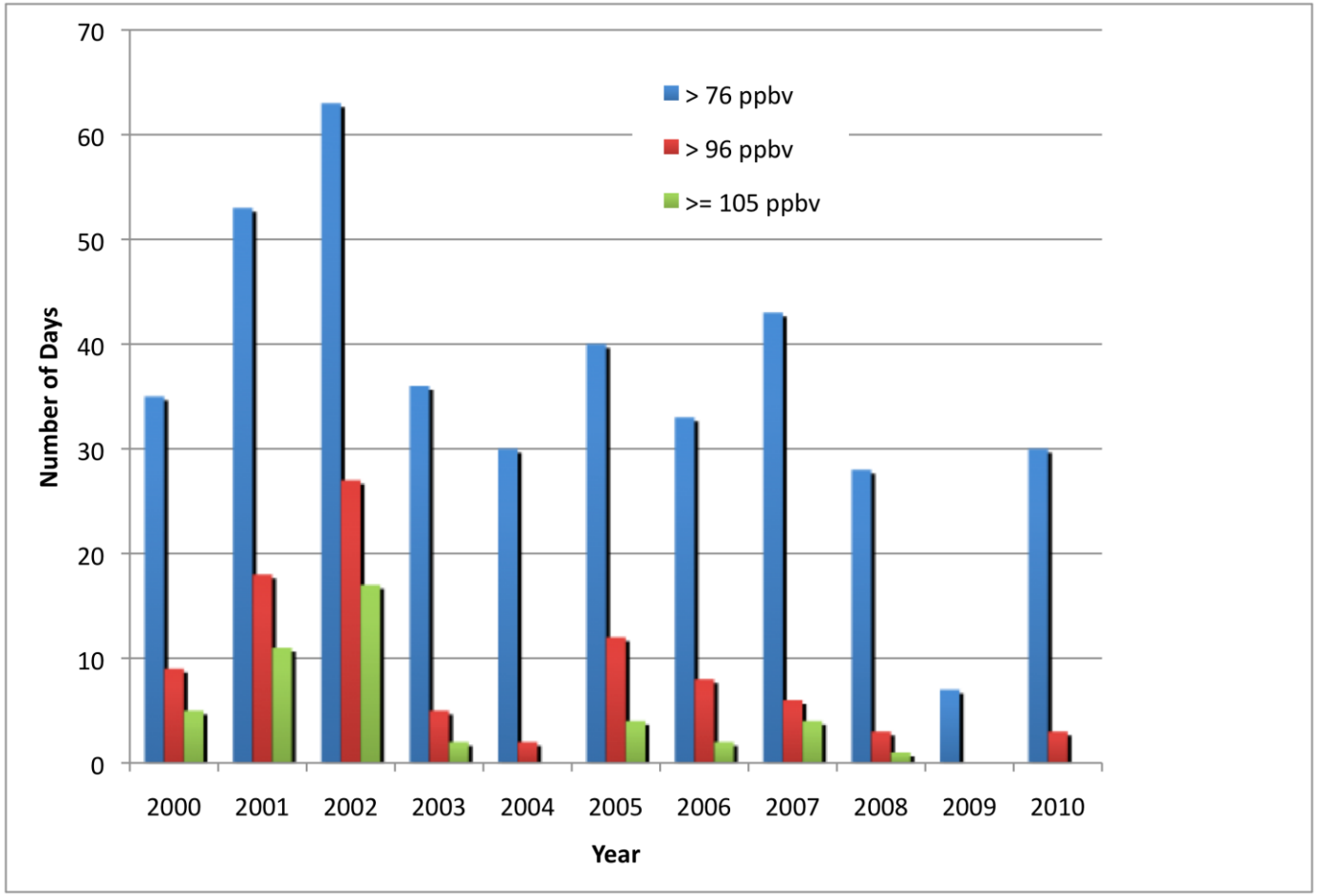
2010 Summer Season Philadelphia Metro Area

William F. Ryan
The Pennsylvania State University
wfr1@psu.edu

2010 Likely Warmest JJA on Record



Air Quality Could Have Been Worse



Model Comparison

Philadelphia Ozone (June 14-September 2, 2010				
	Mean Ozone	Bias	Mean AE	Median AE
OBS	66.6	-	-	-
Operational	71.1	+4.5	9.0	7.0
Experimental	74.5	+7.9	10.0	7.4

Experimental Model produced more ozone than the Operational Model.

Resulted in 5 additional (13 total) False Alarms of Code Orange Ozone. Although additional False Alarms were forecasts in 76-79 ppbv range.

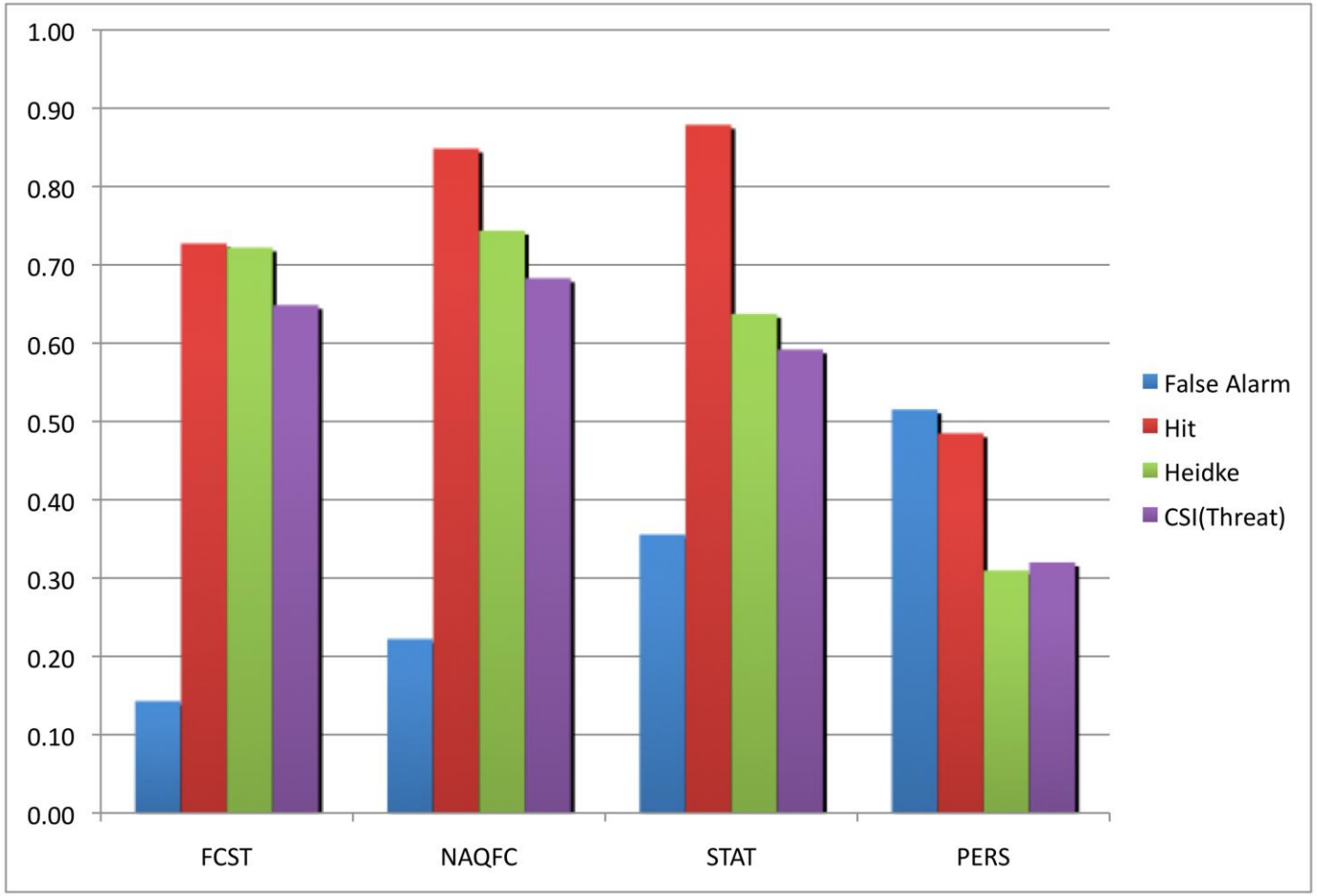
$PM_{2.5}$ Model Results

Philadelphia PM2.5 Forecasts (June 14-September 2, 2010)					
	Mean	Median	Bias	Mean AE	Median AE
OBS	17.9	16.8	-	-	-
FCST	17.4	16.5	-0.5	3.2	2.2
EXPR	15.6	16.0	-2.3	5.0	4.6
PERS	18.0	16.8	0.0	5.0	4.4

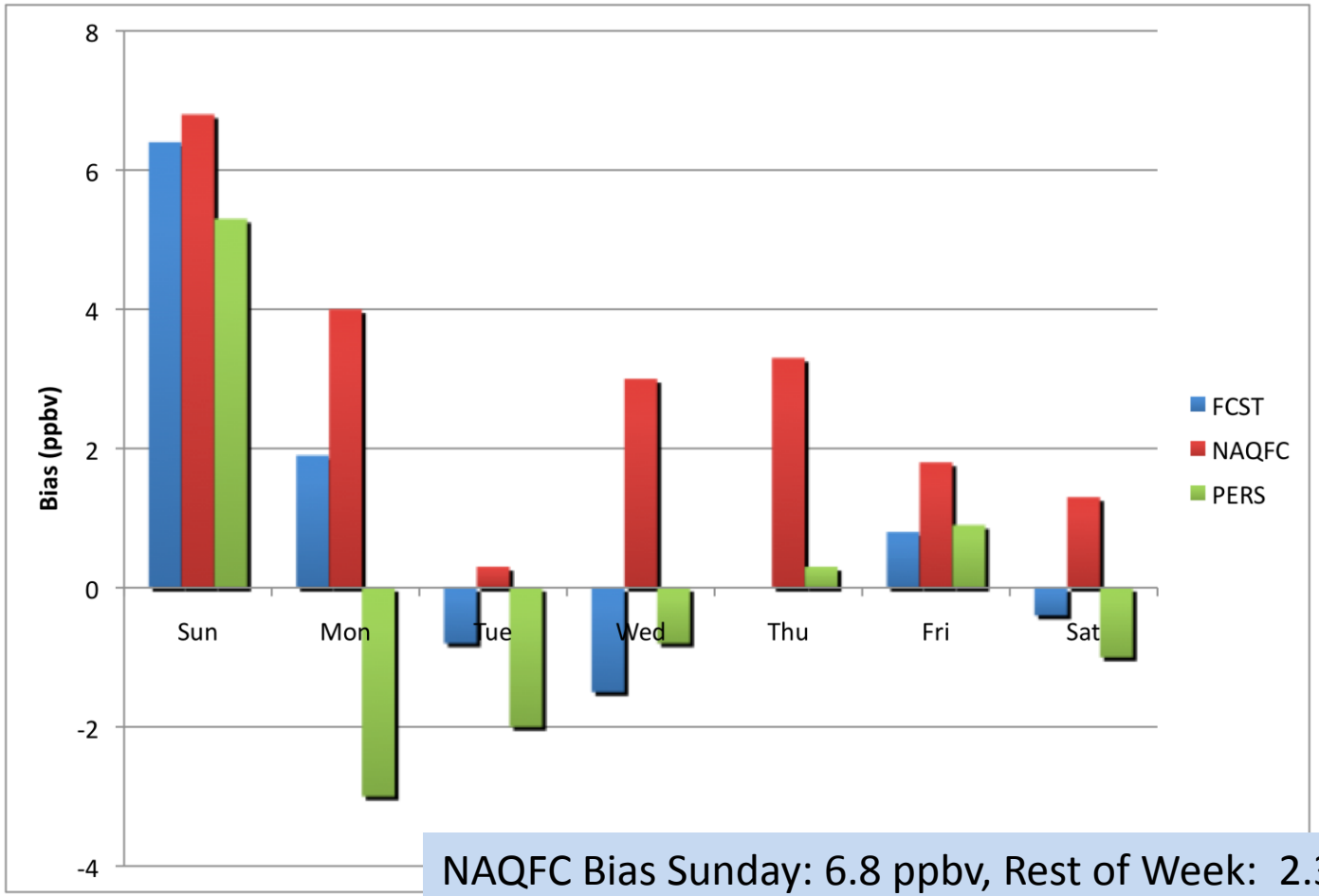
Experimental model under-predicted PM and absolute error was similar to the Persistence forecast.

Note: PM verification is provisional – for PHL we use average of highest 4 continuous monitors as the best estimate of FRM results.

Operational Model: Remarkably Good Results in 2010

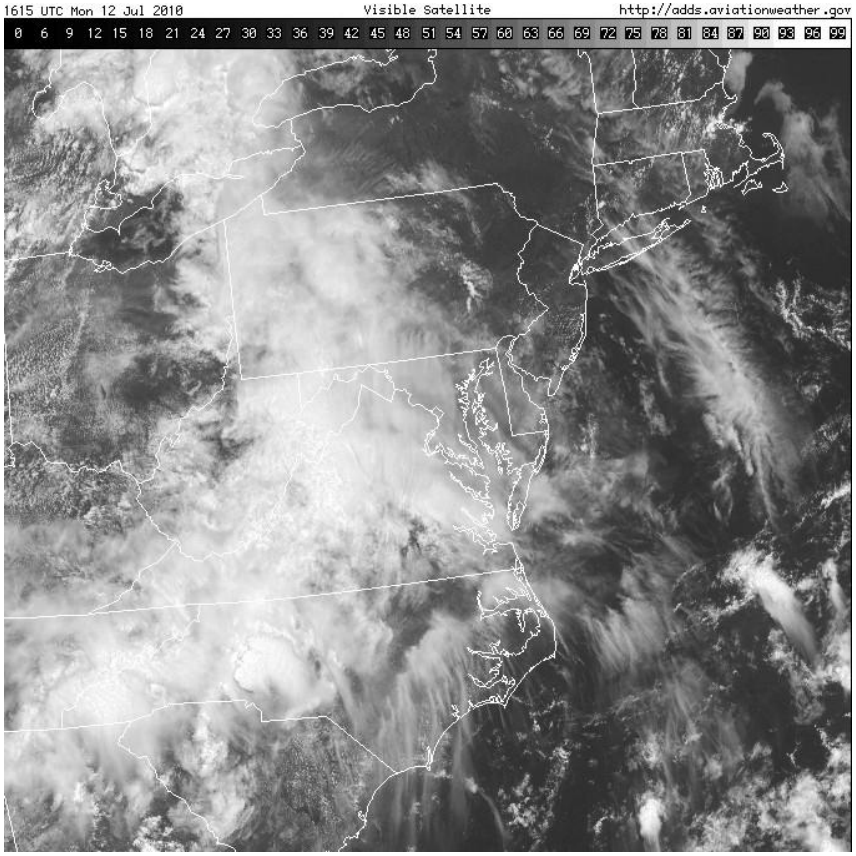


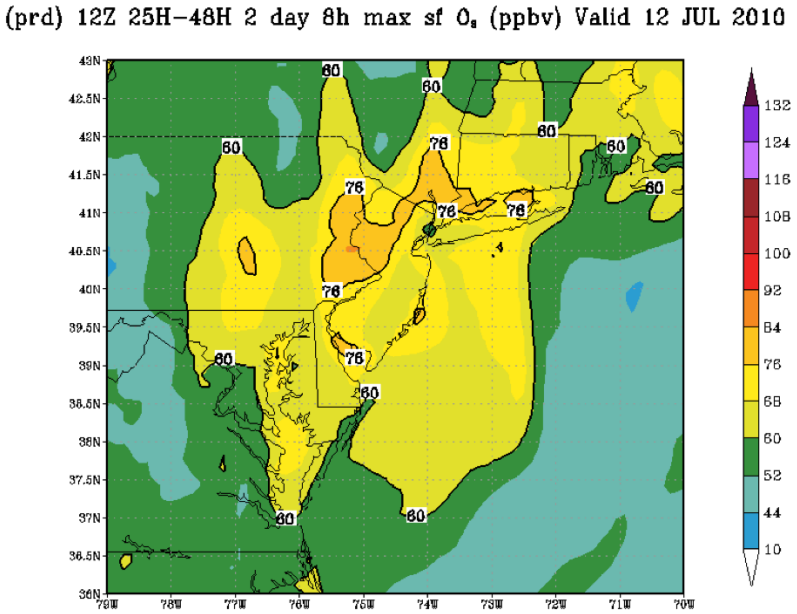
Models Over-Predict Sunday Ozone



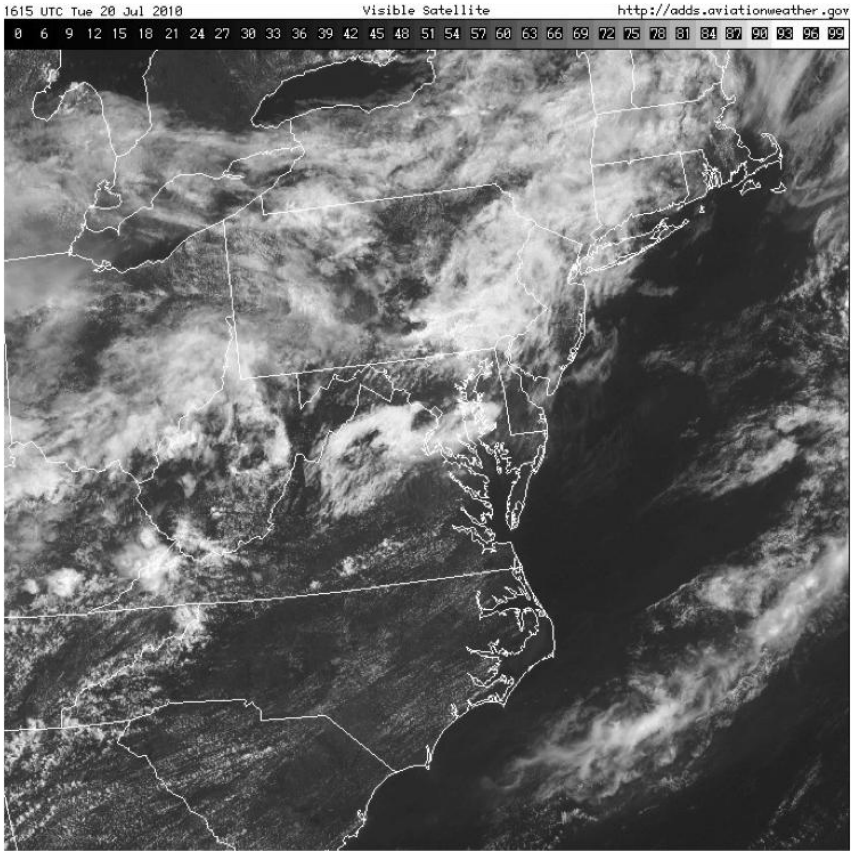
NAQFC Bias Sunday: 6.8 ppbv, Rest of Week: 2.3 ppbv
Expert Bias Sunday: 6.4 ppbv, Rest of Week: 0.0 ppbv

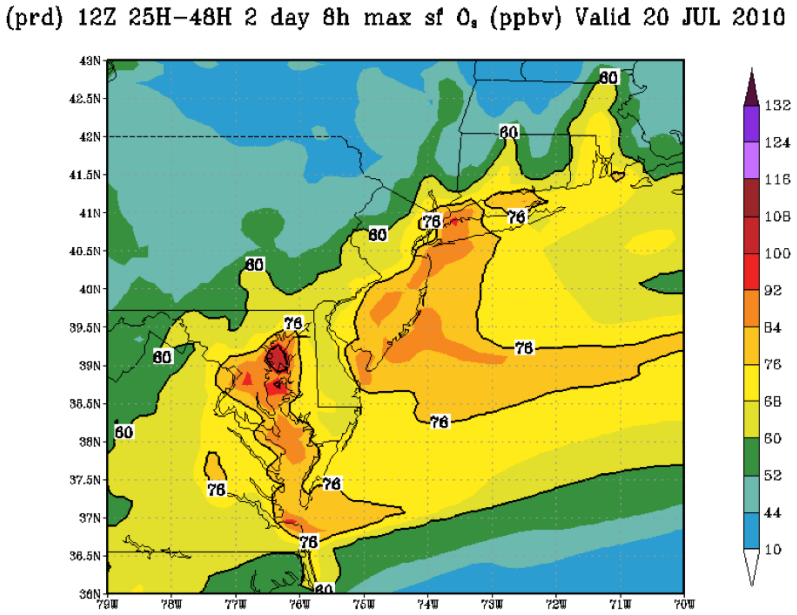
NAQFC False Alarms: Roughly Half Due to Convection/Clouds



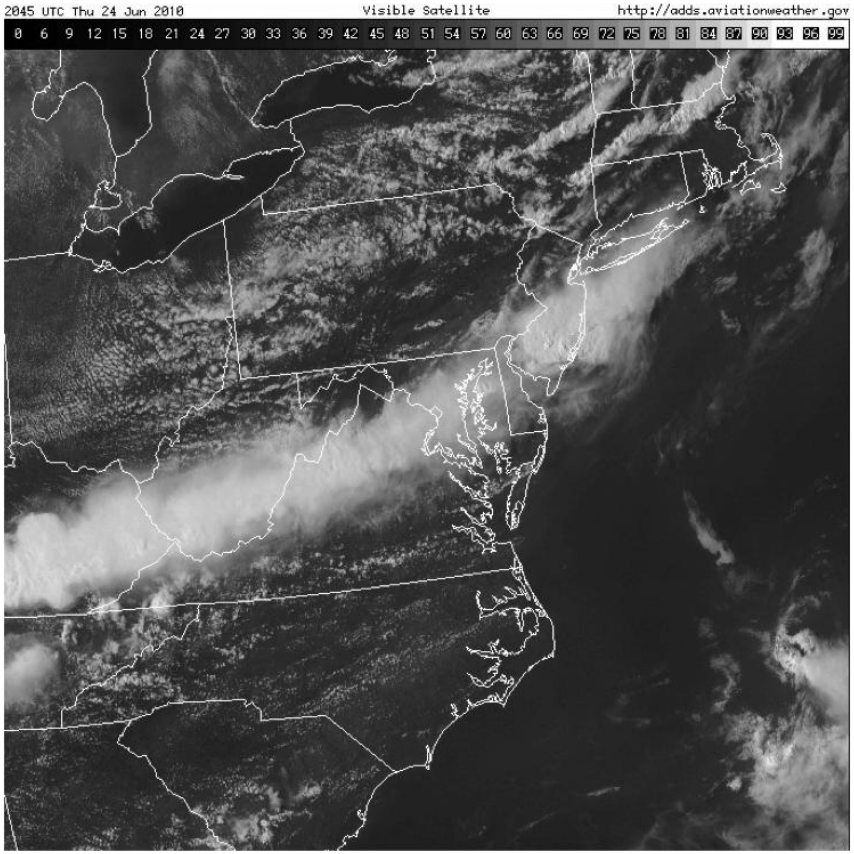


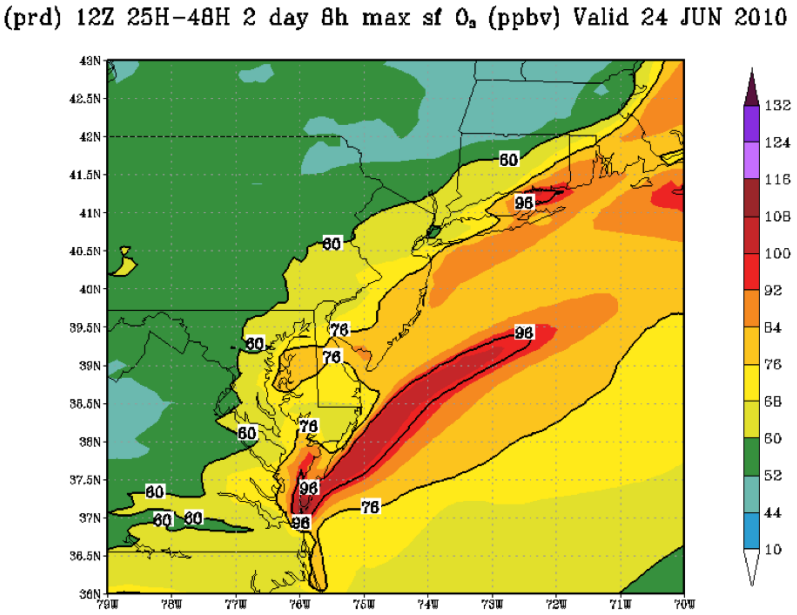
False Alarm: July 20



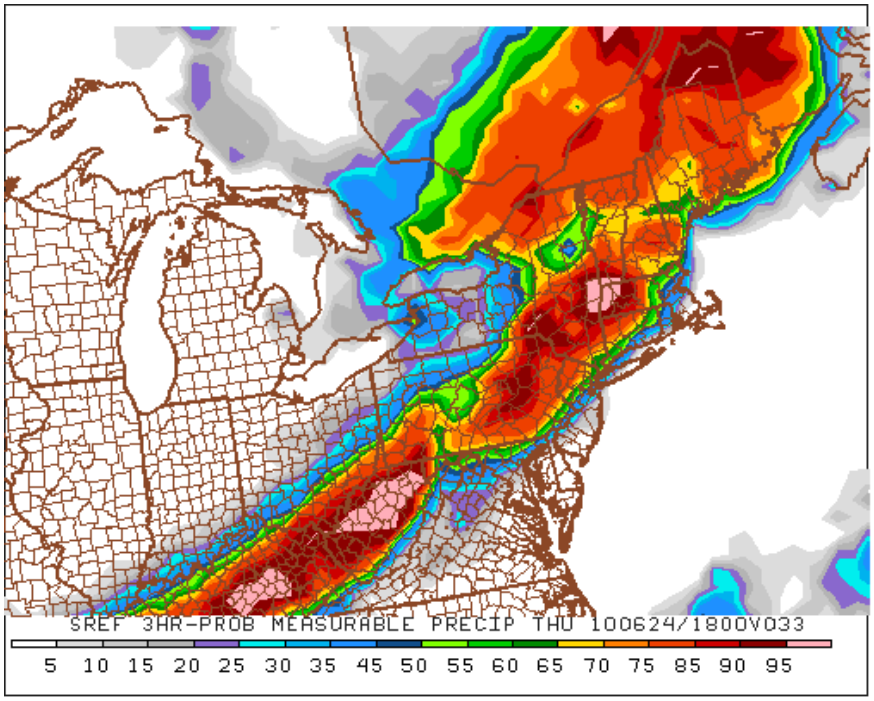


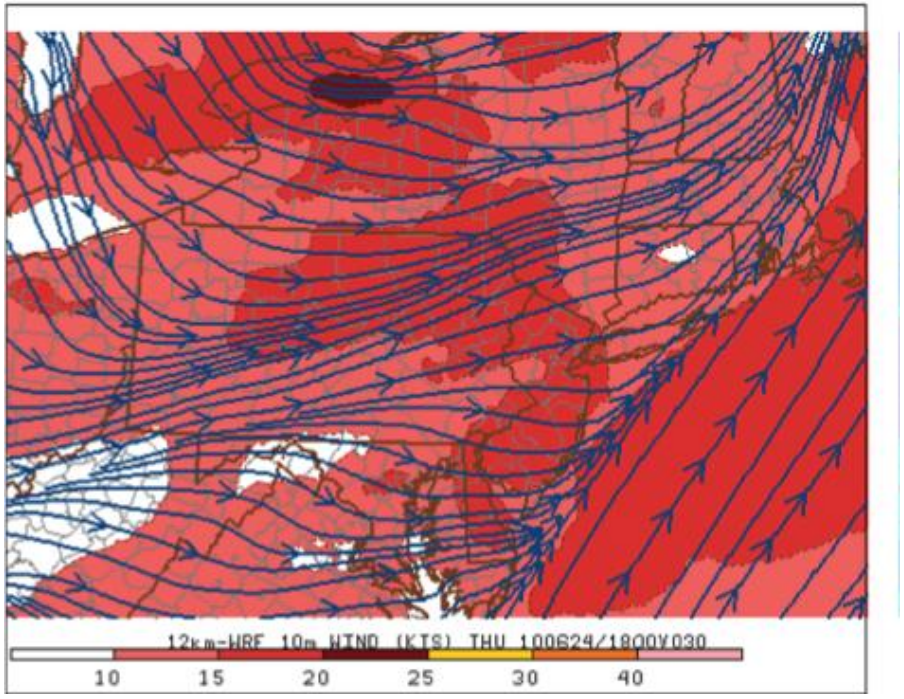
False Alarm, June 24





SREF Picked Up Precipitation and High Wind Speeds on June 24

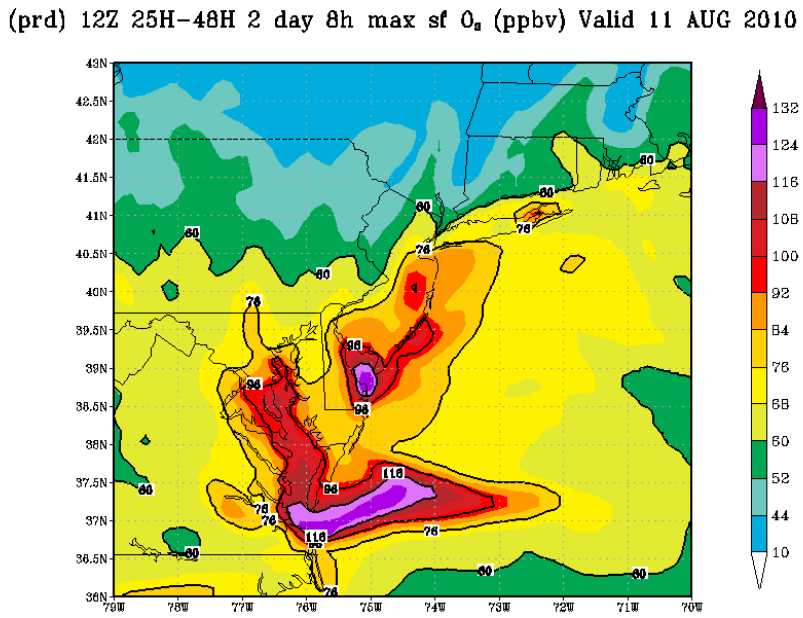


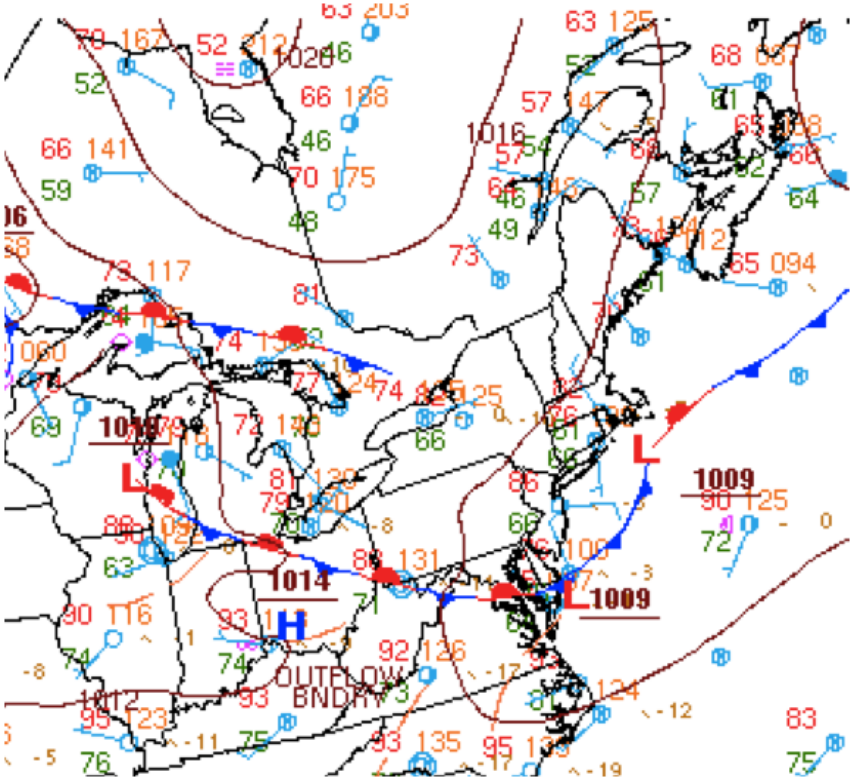


False Alarms

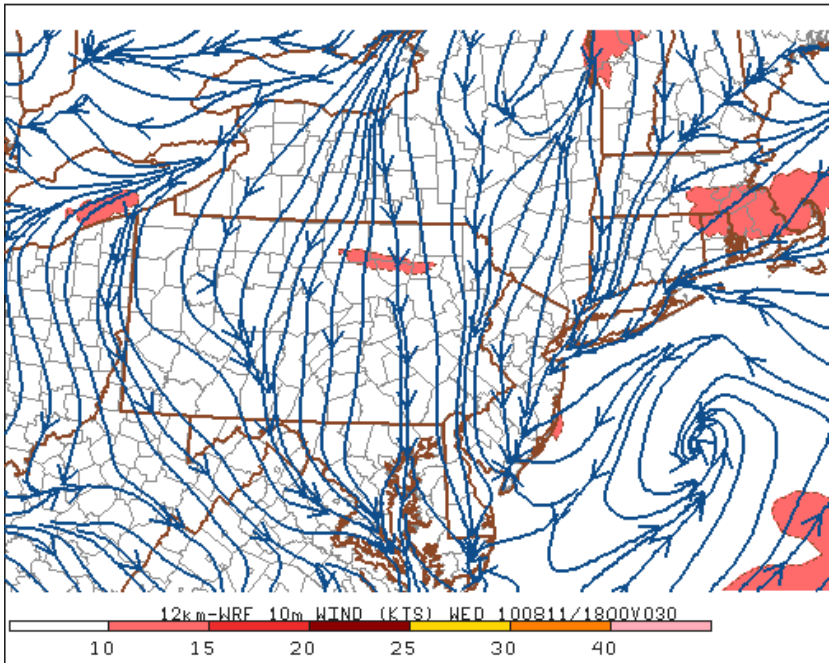
- Other False Alarms were a mixed bag including:
  - Poor meteorological model simulate of weak off shore low.
  - Hot weather with strong winds.
  - Over estimate of stagnation along sea breeze front, but, of 4 similar cases, NAQFC correctly predicted high ozone in 3.

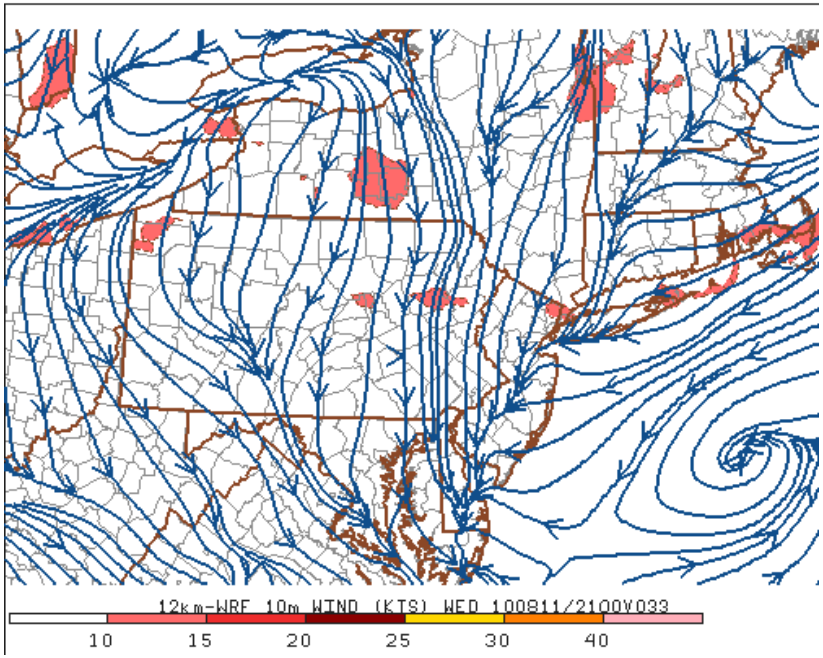
August 11, 2010



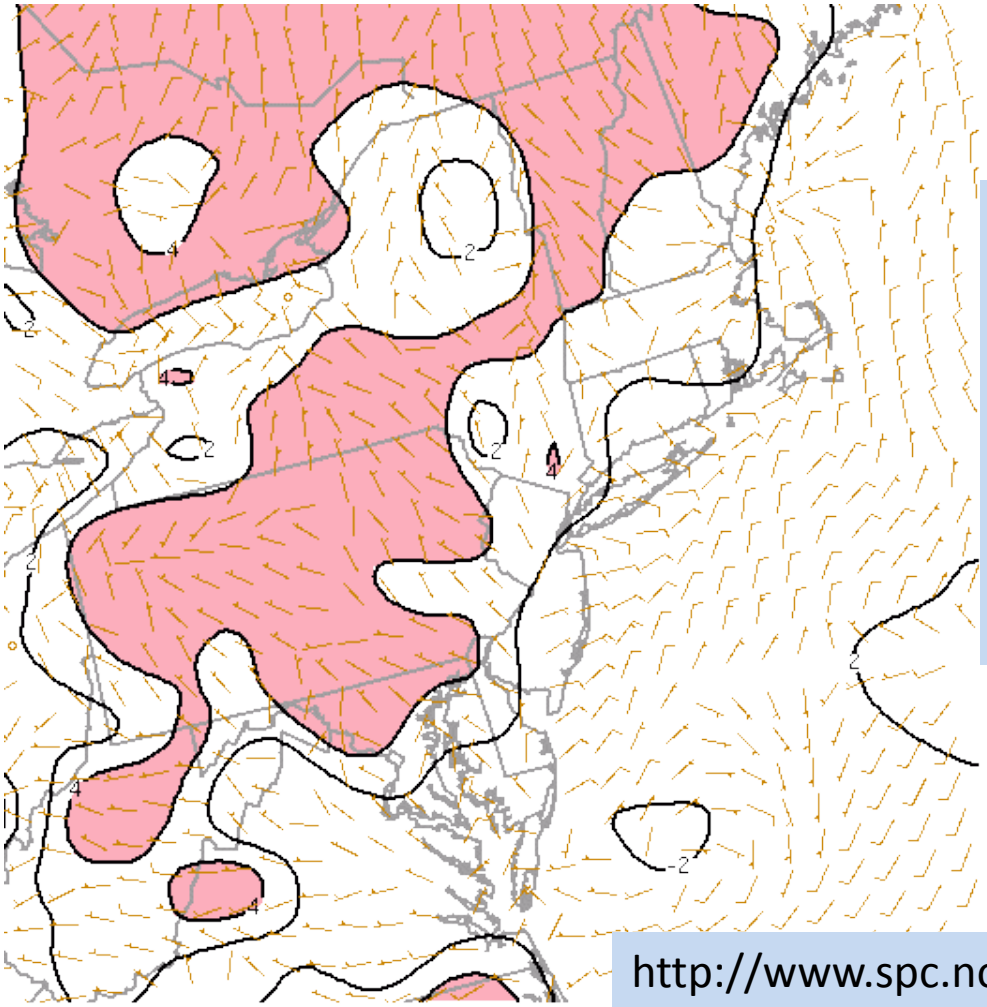


Hi-Res NAM Picks Up Sea Breeze Front Forming Behind Frontal Boundary





Sea Breeze, August 11



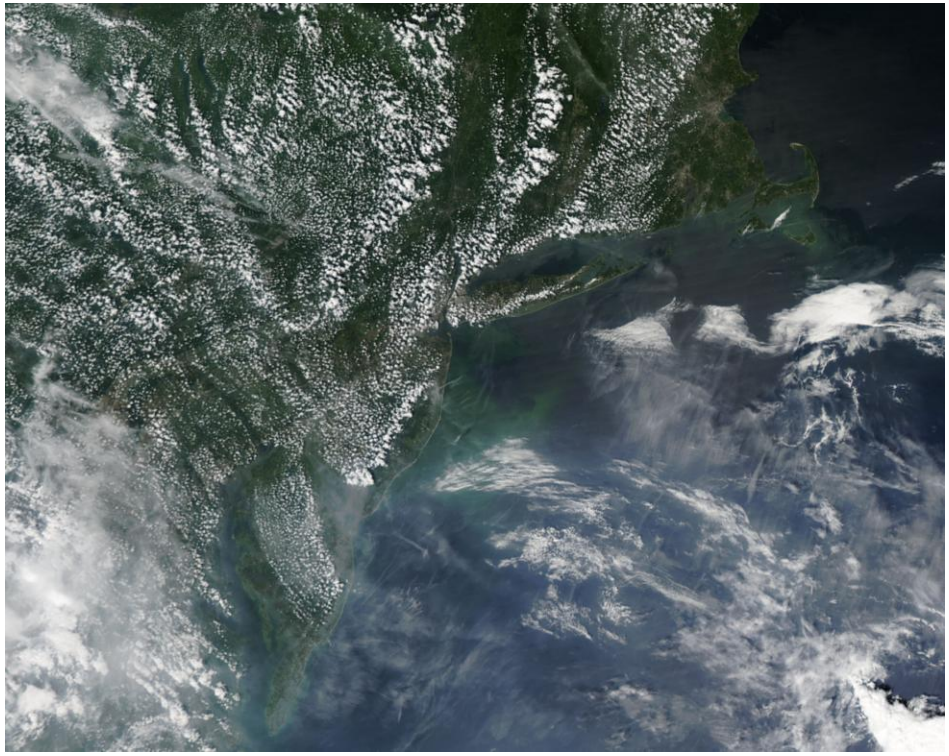
Sea Breeze Verified

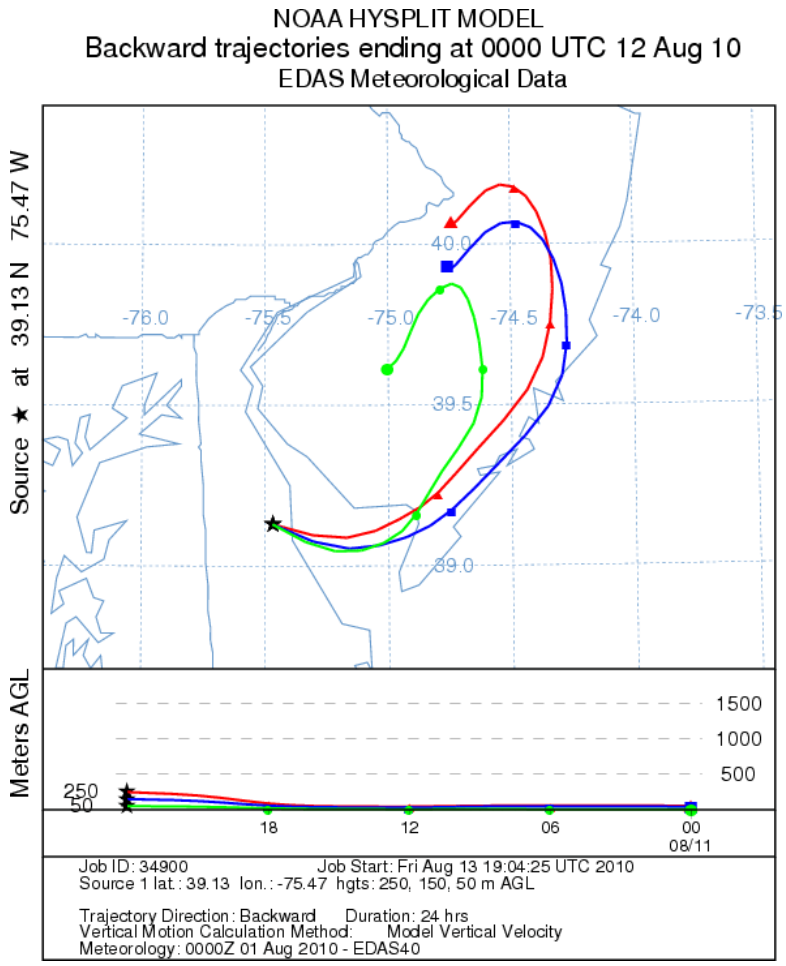
(left) 3-hour temperature change and winds,
1900 UTC, August 11

Figure Courtesy:
SPC Mesoscale Analysis

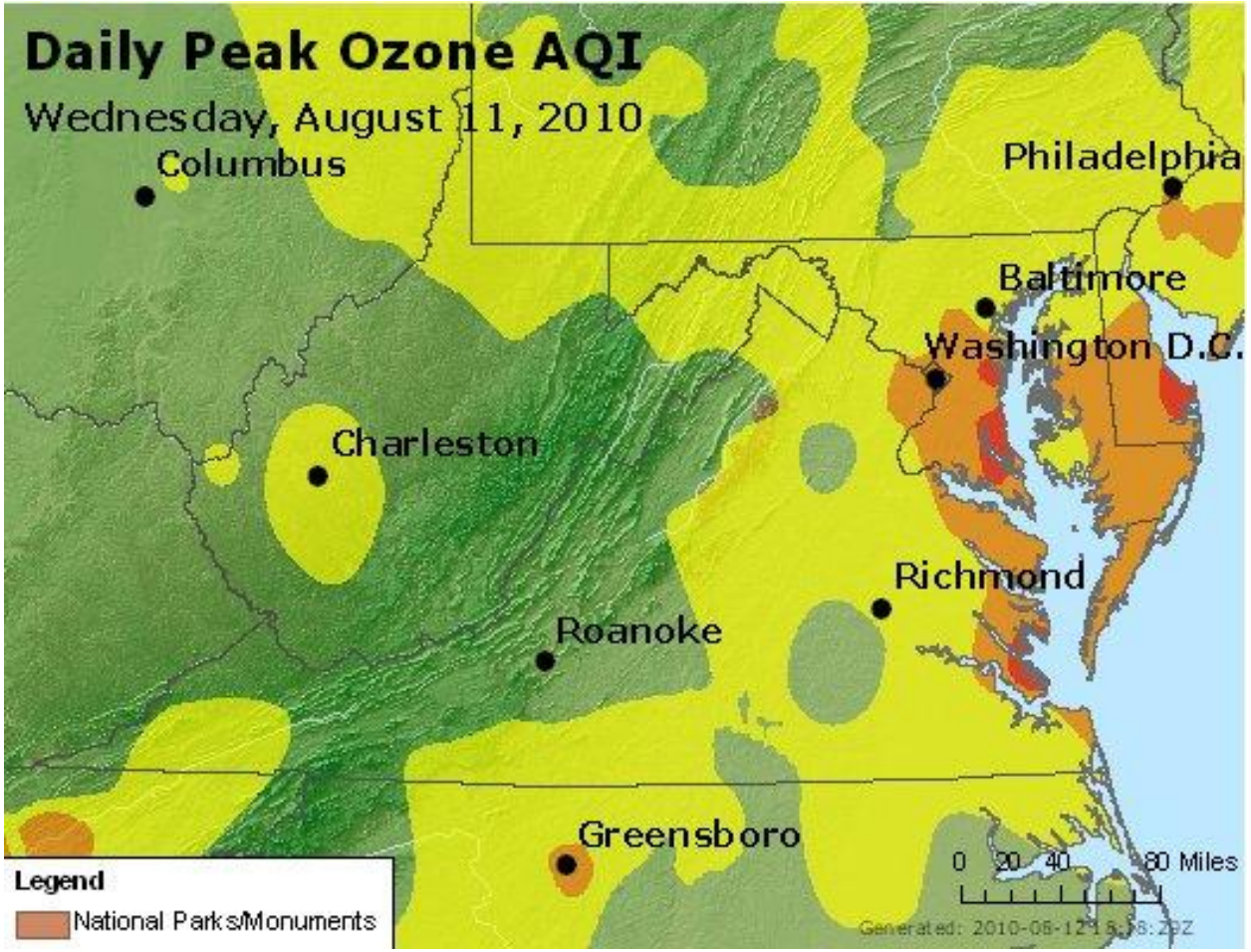
http://www.spc.noaa.gov/exper/mesoanalysis/

Transport Can Be Very Small Scale

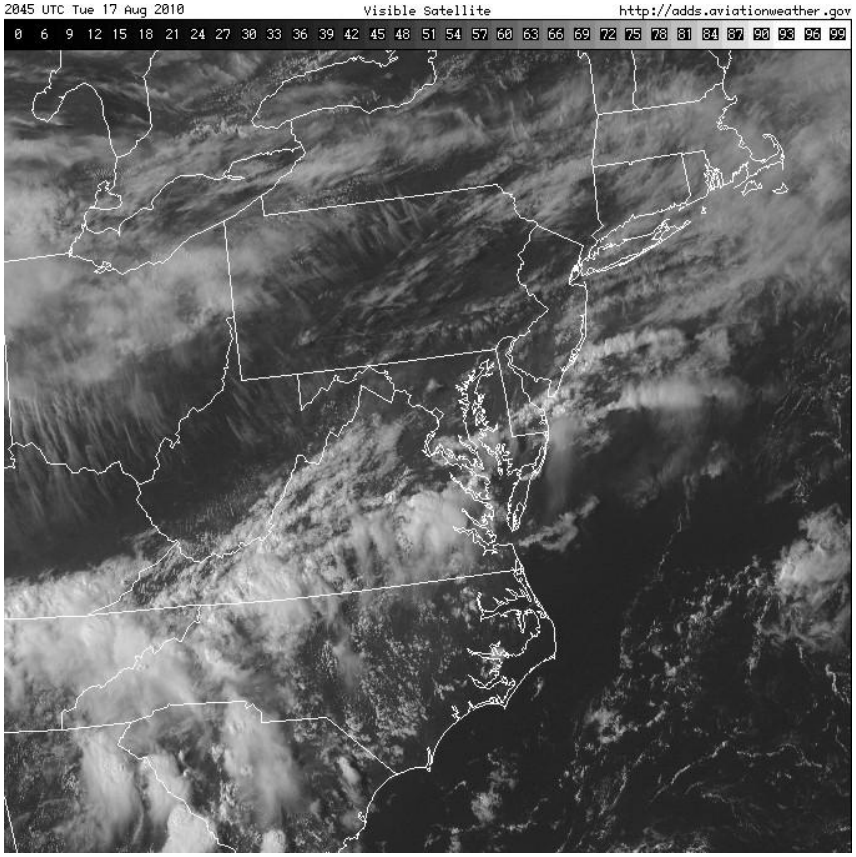


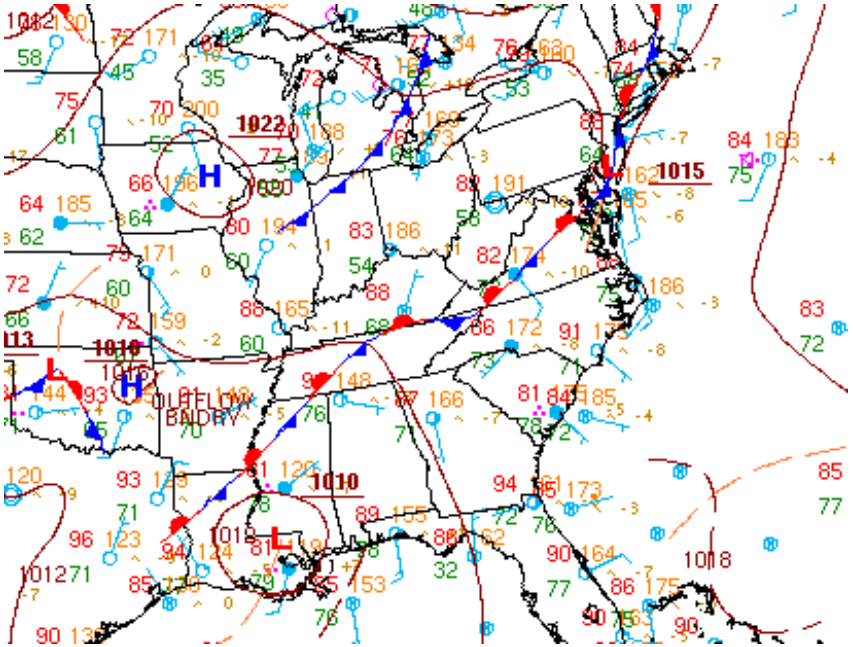


August 11, 2010

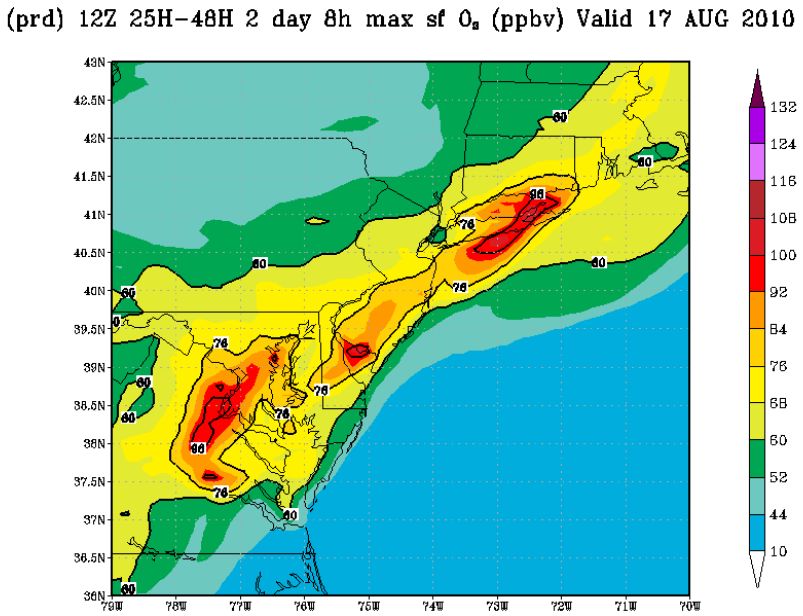


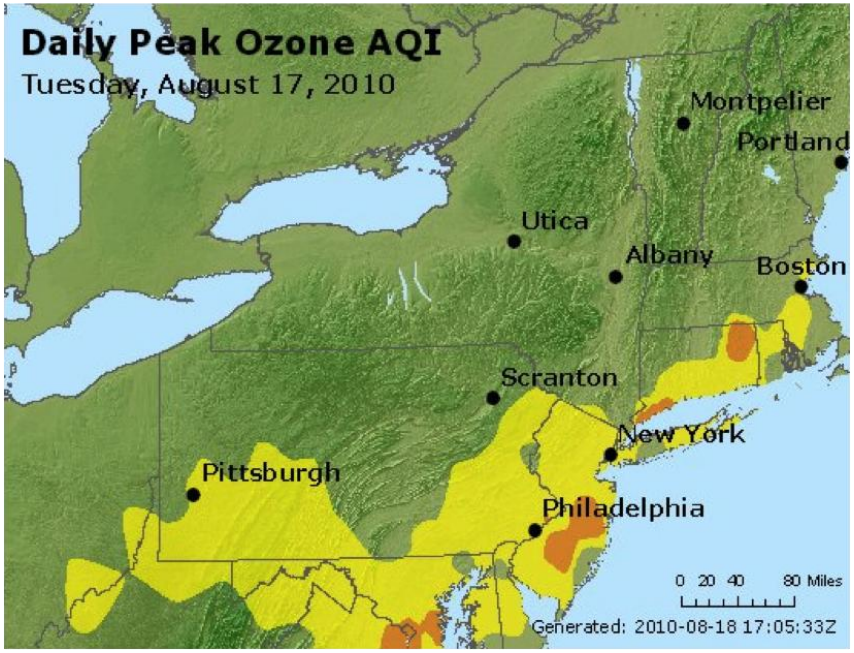
Very Similar Case on August 17





August 17


(prd) 12Z 25H-48H 2 day 8h max sf O_3 (ppbv) Valid 17 AUG 2010
132
124
116
108
100
92
84
76
68
60
52
44
10


Daily Peak Ozone AQI
Tuesday, August 17, 2010
Montpelier
Portland
Utica
Albany
Boston
Scranton
New York
Pittsburgh
Philadelphia
0 20 40 80 Miles
Generated: 2010-08-18 17:05:33Z

Summary

- Experimental Ozone Model introduced over-prediction in PHL with increase in false alarm rate for Code Orange.
- Experimental PM improved over prior years, now ~ equal to persistence.
- Operational Ozone Model performed very well in PHL with skill in difficult frontal/trough boundary cases.
- 2010 a very hot summer with ozone conducive weather but peak ozone magnitude was limited.